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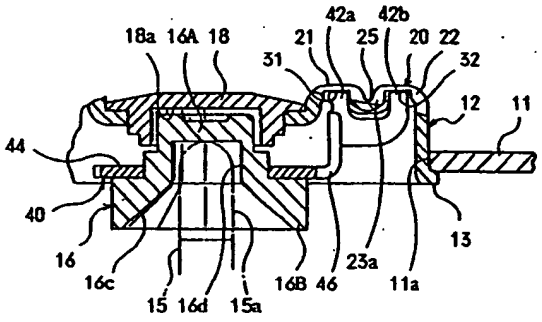
(54) Electric razor.

(57) An electric razor including a plurality of external and internal cutting members (12,40) in which each external cutting member (12) has slits (23a,23b) and a plurality of concentric tracks (31,32) formed in the back and each internal cutting member (40) has a plurality of rows of cutting edges (42a,42b,52a,52b) that can rotate in the concentric tracks (31,32) of the external cutting member (12). The slits (23a,23b) are formed so that imaginary lines extending towards the center of the internal cutting member do not intersect the center of the internal cutting member (40), and the cutting edges (42a,42b,52a,52b) are at the ends of the arms (42,56,57) that extend outwardly from the internal cutting member (40).

FIG. 1



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The present invention relates to an electric razor and more particularly to a multiple-track electric razor.

An electric razor that has two concentric circular shaving surfaces in an external cutting member has been known conventionally. Japanese Patent Application publication No. 41-14339 is one example of this type of electric razor.

In this electric razor, the external cutting member that has hair-entry apertures is provided with, in its shaving surface, a circular partition groove for dividing the shaving surface into inner and outer concentric circular shaving surfaces. The back of the inner and outer shaving surfaces are defined as inner and outer tracks. The internal cutting member, on the other hand, that is used together with the external cutting member, is provided with a plurality of thin-plate-form blades mounted individually on a block formed on the internal cutting member that is rotated by a power source.

More specifically, in this prior art razor, eight angled-U-shape blades are installed in eight grooves formed in radial blocks of the base plate of the internal cutting member. Each one of the angled-U-shape blades has inner and outer cutting edges at the tip ends, and these inner and outer cutting edges are set in the inner and outer tracks of the external cutting member.

When the internal cutting member as described above is used, a plural numbers of thin-plate-form blades must be mounted on the internal cutting member. Welding, pressing, and other works are performed to obtain the internal cutting member. This, however, would cause the blades to be arranged irregularly, and grinding of the blades also takes time. Thus, many parts are required, and a substantial number of steps must be taken to assemble the cutting member and therefore the razors.

The object of the present invention is, therefore, to eliminate problems seen in the existing electric razors and to provide an electric razor that uses an internal cutting member which is obtained from a single sheet of material and has, as an integral body, cutting edges disposed in a concentric circular arrangement.

It is another object of the present invention to provide an electric razor that uses an internal cutting member which has cutting edges that are well arranged and circularly aligned together relative to their leading edges.

The objects of the present invention are accomplished by a unique structure in both the external cutting member and the internal cutting member used in electric razors. The external cutting member has radial slits for letting the hair enter into the external cutting member. These radial slits, which are arranged so that their imaginary extension lines do not intersect the center of the cutting member, are formed on the shaving surface, and the shaving surface is divided into two or more concentric circular shaving surfaces by means of one or more dividing grooves formed circularly and concentrically on the shaving surface. The back of the shaving surfaces are defined as tracks for the cutting edges of the internal cutting member, thus the external cutting member has two or more concentric circular tracks on the back. The internal cutting member, on the other hand, has arms integrally extended from the circumferential edge and bent upright, and a plurality of rows of the cutting edges are concentrically formed at the ends of the arms. These cutting edges are set in the circular tracks so that they can cut the hair when the internal cutting member is rotated.

Each one of the arms which are integral with the internal cutting member is branched into two at the tip end so that the concentric cutting edges are formed at the branched ends.

With the structure above, when the internal cutting member is rotated, the concentric cutting edges of the internal cutting member are rotated within the circular tracks of the external cutting member, thus cutting the hair which has entered through the slits into the external cutting member.

Because the internal cutting member has arms which are upright at the tip ends as an integral part of the cutting member, assembly work is not necessary for obtaining the internal cutting member.

Embodiments of the invention are described, by way of example only, with reference to the following drawings in which:

Figure 1 shows, partially and in cross section, an internal cutting member and an external cutting member fitted together in an electric razor according to the present invention;

Figure 2 is a top view of one of the external cutting members, showing some of the slits formed thereon;

Figure 3 is a front view of the electric razor according to the present invention;

Figure 4 is a front view of the internal cutting member used in the electric razor of the present invention;

Figure 5 is a top view thereof;

Figure 6 is a front view of the internal cutting member of another embodiment according to the present invention;

Figure 7 is a top view thereof;

Figure 8 illustrates how the slits are made in two shaving surfaces of the external cutting member; and

Figure 9 illustrates how the slits are made in a shaving surface of the external cutting member.

A first embodiment of the electric razor of the present invention will be described below with ref-

erence to Figures 1 through 5.

As shown in Figure 3, the housing 10 of the electric razor has a shaving frame 11 on the upper front portion. The shaving frame 11 is substantially in a reversed triangle shape and has a substantially flat surface. In this shaving frame 11, three external cutting members 12 are installed with equal distance in between, forming a reversed triangle.

Figure 1 shows one of the three external cutting members installed in the shaving frame 11.

The external cutting member 12 has a shallow cap-shape as a whole with a round top. The cylindrical periphery of the external cutting member 12 has a flange 13 at the lower edge which is bent outwardly for the entire circumference. The flange 13 is for preventing the cutting member 12 from coming off of the shaving frame 11. The external cutting member 12 has a hole at the center, and a center cover 18 is installed fixedly in this hole. The center cover 18 has a rear recess 18a on the back.

The external cutting members 12 thus structured are installed in the shaving frame 11 from the back by pressing them into apertures 11a opened in the shaving frame 11. Each external cutting member 12 in the aperture 11a is installed so as to be movable slightly in the axial direction (or slightly depressable) but not rotatable. With the flange 13, the external cutting member 12 does not come off of the shaving frame 11.

A more detailed description of the external cutting member will be described below.

The area around the center cover 18 of the outer surface of the external cutting member 12 is defined as a shaving surface 20 that comes into contact with skin when shaving is performed. The shaving surface 20 has two circular shaving surfaces: the inner shaving surface 21 and the outer shaving surface 22. Between these shaving surfaces 21 and 22, there is a circular groove 25 that protrudes downwardly (in the drawing). The back of the inner shaving surface 21 is an inner circular track 31, and the back of the outer shaving surface 22 is an outer circular track 32.

The external cutting member 12 is formed with a plurality of slits that allow the hair to come into the circular tracks 31 and 32 from outside. As seen from Figures 1 and 2, two different types of slits are formed on the shaving surfaces: the first slits 23a and the second slits 23b. The first slits 23a are formed radially and across both the inner and outer circular shaving surfaces 21 and 22. The second slits 23b, to the contrary, are formed radially and across only the outer circular shaving surface 22. The slits 23a and 23b have a predetermined depth. Figure 2 only shows three first and second slits 23a and 23b, though in actuality, these slits are formed alternatively for the entire shaving surface 20.

As described above, in the outer circular shaving surface 22 both the first and second slits 23a and 23b are formed alternatively for its entire surface; thus, the number of slits counted on the outer circular shaving surface 22 is twice the number of the slits formed in the inner circular shaving surface 21. Since the outer circular shaving surface 22 which is wider in the radial direction than the inner circular shaving surface 21 has twice the number of the slits the inner circular shaving surface 21 has. Accordingly, the distance between the two types of slits next to each other in the outer circular shaving surface 22 is substantially the same as the distance between the two types of slits formed in the inner circular shaving surface 21.

Figure 3 shows a different arrangement of the slits in the shaving surface 20. In this embodiment of Figure 3, only one type of the slits, which are the first slits 23a (that are longer than the second ones), are formed, and these slits 23a are across both the inner and outer circular shaving surfaces 21 and 22. In other words, the external cutting member 12 in Figure 3 does not have the second slits 23b that are across only the outer circular shaving surface 22.

As seen from the above, the external cutting member 12 in Figure 3 has the same number of slits on both the inner and outer circular shaving surfaces 21 and 22. Furthermore, the slits in the embodiment of Figure 3 are formed with a predetermined angle compared to the slits formed radially as shown in Figure 2. More specifically, the slits in the embodiment of Figure 3 are formed at a predetermined angle (about 5°, for instance) relative to the radius of the cutting member; in other words, the imaginary lines extended inwardly from the slits do not intersect the center of the external cutting member 12. It, of course, is possible that the angled-slit-arrangement as described above is applied to an external cutting member that has both the first and second slits 23a and 23b that are formed in the inner and outer shaving surfaces 21 and 22, respectively.

A description of the internal cutting member 40 will be given below with reference to Figures 1, 4 and 5.

As particularly seen from Figure 5, the internal cutting member 40 has a row of inner cutting edges 42a and a row of outer cutting edges 42b which are, as seen in Figure 1, brought into the inner circular track 31 and the outer circular track 32, respectively.

The internal cutting member 40 has a circular base 44 at the center, and ten arms 46 extend outwardly from the circumferential edge of the circular base 44. These arms 46 are integral with the circular base 44 and equally spaced with each other in the circumferential direction. More specifi-

cally, each one of the arms 46 extends in the radial direction for some distance and is bent upright at approximately 90° (upward in Figure 4). The upright portion of the arm 46 with a predetermined width is at a right angle relative to the radius of the circular base 44 and extends vertically (in Figure 4), and then, from this point, the arm 46 extends, with its width gradually reducing, slantingly (in Figure 4), which is in the direction between a counter-rotational direction (counter-clock wise in Figure 5) and a perpendicular direction of the internal cutting member 40. In other words, the top of the upright portion of the arm is twisted. The arm 46 further extends in the direction of the radius of the circular base 44 and then has a cutter 42 which is integral with the arm 46.

The cutter 42 is branched into a U-shape so that it has at the top an inner cutting edge 42a and an outer cutting edge 42b. The cutter 42 has a flat plate shape and sets its angle, relative to the circular base 44, so that it extends slantingly in the direction between the rotational direction (clockwise in Figure 5) and the perpendicular direction (upward in Figure 4). In other words, the cutter 42 is slanted in the direction of rotation when viewed from the front (or sides) as shown in Figure 4.

In addition, the inner cutting edge 42a and the outer cutting edge 42b have flat top surfaces (as seen in Figure 4). The leading edges of the inner and outer cutting edges 42a and 42b are arranged so that an inwardly extended imaginary straight line from the two leading edges of the cutting edges 42a and 43b comes across the center of the circular base 44 or the center of the internal cutting member 40 (as viewed in Figure 5). Furthermore, all the cutting edges 42a and 42b of the internal cutting member 40 are formed so that, when the external cutting member 40 and the internal cutting member 12 are assembled together as shown in Figure 1, the inner and outer cutting edges 42a and 42b come into close contact with the inner and outer circular tracks 31 and 32, respectively, of the external cutting member 12.

In the above description, the circular base 44, the arms 46, the cutters 42 and the inner and outer cutting edges 42a and 42b are made from a single metallic plate.

As seen in Figure 1, into the hole at the center of the circular base 44 of the internal cutting member 40 is brought a transmission block 16 from the back (from underneath in Figure 1) so that the intermediate diameter portion of the block 16 is securely fitted in the center hole of the circular base 44. The transmission block 16 transmits the driving force of the electric razor to the internal cutting member 40.

The transmission block 16 has a small diameter portion (the upper most portion in Figure 1), which is at the top of the transmission block 16 and defined as a guide part 16A. The transmission block 16 also has a large diameter portion, which is at the base (or the lower most portion in Figure 1) of the transmission block 16 and is defined as a driving force transmission part 16B. The drive force transmission part 16B has a cone-shaped entrance 16c; and above this entrance 16 and inside the intermediate diameter portion is a connection hole 16d which has a substantially rectangular cross section. Thus, when the tip end 15a of a drive shaft 15 is fitted in the connection hole 16d, the drive force from a driving source (not shown) is transmitted to and rotates the internal cutting member 40.

Figure 1 shows the internal and external cutting members 12 and 40 as assembled. The guide part 16A of the block 16 which is secured to the internal cutting member 40 is brought into the rear recess 18a of the center cover 18 of the external cutting member 12. As a result, any movement of the internal cutting member 40 in the radial direction is prevented. In addition, when the internal and external cutting members 40 and 12 are assembled as in Figure 1, the inner cutting edge 42a and the outer cutting edge 42b of the internal cutting member 40 come into close contact with the inner and outer circular tracks 31 and 32, respectively. As a result, when the internal cutting member 40 is rotated by the driving force transmitted to it, the cutting edges 42a and 42b of the internal cutting member 40 are rotated, keeping in contact with the inner and outer circular tracks 31 and 32 of the external cutting member 12, cutting the hair.

Figures 6 and 7 illustrates another internal cutting member 50 according to the present invention.

The internal cutting member 50 in these Figures has inner cutting edges 52a and outer cutting edges 52b which are brought into the inner circular track 31 and the outer circular track 32 of the external cutting member 12 in the same manner as the internal cutting member shown in Figure 1.

The internal cutting member 50 comprises a circular base 54, inner arms 56 and outer arms 57. The inner arms 56 stand uprightly (or upwardly in Figure 6) at the circumferential edge of the circular base 54. There are eight inner arms 56, and they are integral with the circular base 54 and arranged with equal intervals. Each one of the upright inner arms 56 has a predetermined width and is at a right angle relative to the radial direction of the circular base and extends perpendicularly (or upwardly in Figure 6). The arm 56, with its width gradually reducing, extends slantingly for some distance in the direction between the counter-rotational direction (counterclockwise in Figure 7) and the vertical direction (or upward direction in Figure 6), and then it further extends for some distance to bend outwardly. The arm 56 thus shaped has the

inner cutting edge 52a at the tip end. The cutting edge 52a has a flat top surface.

On the other hand, the outer arms 57 extend outwardly and horizontally (in Figure 6) from the circumferential edge of the circular base 54, the outer arms 57 being longer than the inner arms 56. There are eight outer arms 57 which are integral with the circular base 54 and equally spaced with each other in the circumferential direction with the eight inner arms 56 in between. Each one of the upright inner arms 57 has a predetermined width and is at a right angle relative to the radial direction of the circular base and extends perpendicularly (or upwardly in Figure 6). The arm 57, with its width gradually reducing, extends slantingly for some distance in the direction between the counter-rotational direction (counterclockwise in Figure 7) and the vertical direction (or (upward direction in Figure 6), and then it further extends for some distance to be bent outwardly. The arm 57 thus shaped has the outer cutting edge 52b at the tip end. The cutting edge 52b has a flat top surface.

As to these cutting edges of the external cutting member, an imaginary straight line drawn along the leading edge of each one of the inner cutting edges 52a and each one of the outer cutting edges 52b is at a predetermined angle relative to the diameter of the circular base 54 of the internal cutting member 50. In other words, each cutting edge has a predetermined lateral rake-angle so that when the internal and external cutting members 50 and 12 are assembled as shown in Figure 1, all the inner cutting edges 52a and outer cutting edges 52b of the internal cutting member 50 come in close contact with the inner and outer circular tracks 31 and 32, respectively.

The circular base 54, the inner arms 56, the outer arms 57, the outer cutting edges 52a, and the inner cutting edges 52b are made from a single metallic plate. The rest of the structure of the internal cutting member 50 is the same as the one shown in Figures 3 and 4.

When the internal cutting member 40 shown in Figures 4 and 5 and the internal cutting member 50 shown in Figures 6 and 7 are compared, the internal cutting member 40 has ten inner cutting edges 42a and ten outer cutting edges 42b which are obtained from a single material; to the contrary, only eight inner cutting edges 42a and eight outer cutting edges 42b are formed in the internal cutting member 50. Thus, the internal cutting member 40 has 10/8 times more cutting edges than the internal cutting member 50. As a result, when the internal cutting member 40 is used, the drive shaft 15 can rotate at a speed of 8/10 of the speed of the cutting member 50. When the drive shaft 15 is rotated thus slower via the use of the cutting member 40, vibrations and noises can be less than the inner cutting member 50 which is rotated faster.

A description of the method for making the external cutting member 12 will be presented.

The slits of the shaving surface 20 of the external cutting member 12 are formed on the shaving surfaces 21 and 22 by use of a rotary cutter 70.

For opening the first slits 23a into the shaving surfaces 21 and 22, the rotary cutter 70 is positioned to come into contact with the shaving surfaces 21 and 22 and then moved toward the back of the external cutting member 12 (see Figure 8). For opening the slits 23b in the outer side shaving surface 22, the rotary cutter 70 is moved to a position where it comes into contact with only the outer circular shaving surface 22. Then, the rotary cutter 70 is moved toward the back of the external blade 12 while being kept in contact with the outer shaving surface 22 (see Figure 9).

In either case, after making one slit, the external cutting member is rotated by a predetermined distance, and the slit forming is repeated for the entire surfaces. The slits 23a and 23b are the deepest at the outer circumference of the outer circular shaving surface 22.

In the embodiments described above, the shaving surface 20 is divided into two concentric circular surfaces to form the two concentric circular tracks 31 and 32 (or in a "dual-track" formation), and the inner and outer cutting edges are rotated inside the two circular tracks, respectively. However, the shaving surface and therefore the tracks of the external cutting member may be formed in triple, quadruple, or quintuple in number. If these plural (more than two) shaving surfaces and plural (more than two) tracks are employed, then the internal cutting member is provided with a plurality of rows of concentric cutting edges that correspond to the number of the circular tracks.

The internal cutting members described above may be obtained by cutting, pressing, bending, etc. strips of steel or other suitable metal of a prior art technique.

In addition, each of the internal cutting members of the present invention is formed so that a plurality of integral arms extend from the circumferential edge of the circular base of the cutting member, and the cutting edges are at the ends of the arms concentrically. Thus, the internal cutting members are obtained from a single sheet of material by cutting and bending. Accordingly, the internal cutting members obtained according to the present invention can have cutting edges that are regularly and uniformly arranged (in height, direction, length, etc.) compared to the prior art cutting members that are made out of several parts that are welded, pressed, etc.

Furthermore, the number of parts that make the internal cutting member of the present invention is less than those of the prior art cutting members; as a result, the steps needed to obtain the cutting member are less, and the time required to obtain the cutting member is short, and the cost of manufacturing is low.

Furthermore, the cutting member shown in Figures 4 and 5 can have more cutting edges than the cutting member in Figures 7 and 8; accordingly, the rotating speed for the cutting member of Figures 4 and 5 can be low with less vibrations and noises.

Claims

1. An electric razor comprising:

an external cutting member having a round shaving top surface, said top surface being provided with a plurality of radial slits for hair entry and divided into a plurality of concentric shaving surfaces by way of a plurality of concentric grooves; and

an internal cutting member comprising a circular base and cutting edges that cuts hair entering through said slits of said external cutting member, said cutting edges being provided at the ends of said arms which are integrally provided upwardly on said circular base which is rotated via a power source and rotated along back surfaces of said plurality of circular shaving surfaces of said external cutting member.

2. An electric razor according to Claim 1, wherein said arms of said internal cutting member is divided into the same number as said plurality of circular shaving surfaces and said cutting edges are formed on said divided tip ends so as to slide along said back of said circular shaving surfaces.

3. An electric razor according to Claim 1, wherein said plurality of arms differs in length so as to correspond to the number of said plurality of circular cutting surfaces of said internal cutting and said cutting edges are provided at the ends of said arms.

4. An electric razor comprising an external cutting member having a plurality of concentric circular tracks in the back and an internal cutting member having a plurality of rows of concentric cutting edges in which said external cutting member has circular shaving surfaces on outer surfaces of said circular tracks, circular grooves formed between said circular shaving surfaces, and hair-entries formed so as to penetrate from said circular concentric shaving surface to said circular tracks, and said cutting edges of said internal cutting member are rotated inside said circular tracks, wherein:

a plurality of arms are integrally provided upwardly from the circumference of a circular base of the center of said internal cutting member and said cutting edges are concentrically formed at the ends of said arms.

5. An electric razor according to Claim 4, wherein each one of said arms is branched and said concentric cutting edges are formed at said branched ends.

6. An electric razor according to Claim 4, wherein said hair-entries are slits.

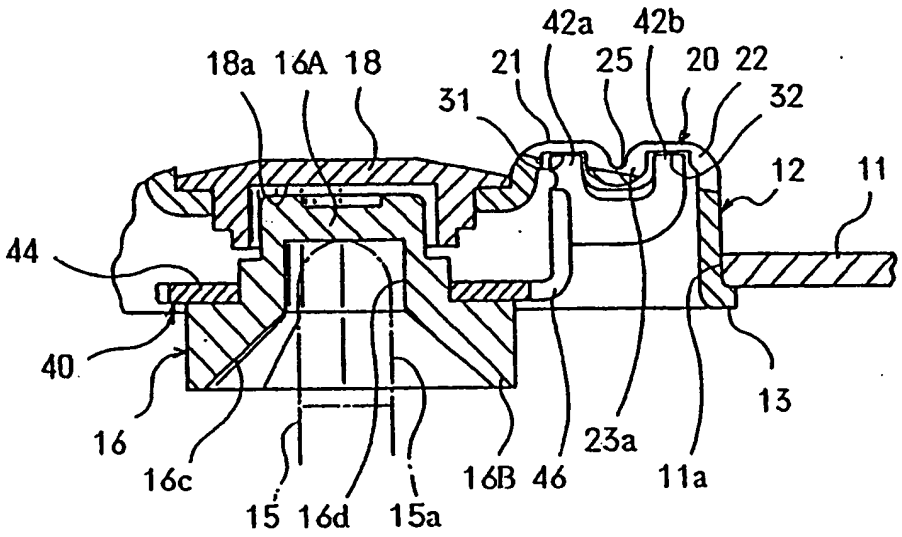
7. An electric razor comprising a plurality of external cutting members and internal cutting members, wherein:

each one of said external cutting members comprising a plurality of concentric circular shaving surfaces with the back thereof being defined as circular tracks and a plurality of slits, said slits being formed in substantially radial direction; and

each one of said internal cutting members comprises a circular base, arms extending from the circumferential edge of said circular base and bending upwardly so that said bent ends have a plurality of rows of concentric cutting edges which are set in said circular tracks of said external cutting member.

8. An electric razor according to Claim 7, wherein said slits are formed so as to cross said plurality of concentric circular shavings with an imaginary line inwardly extending from each one of said slits not intersecting a center of said internal cutting member.

FIG. 1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42b
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16A
18
21
25
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31
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44
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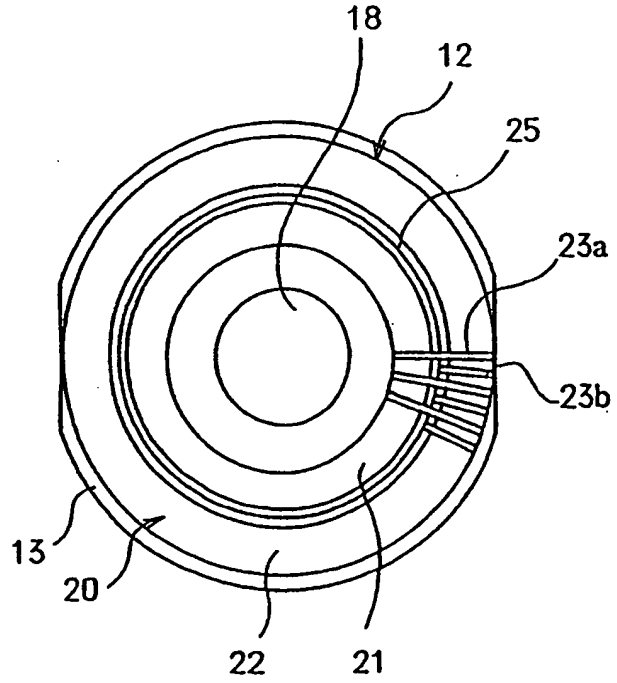
16c
16B
46
11a
15
16d
15a

FIG. 2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21

FIG. 3

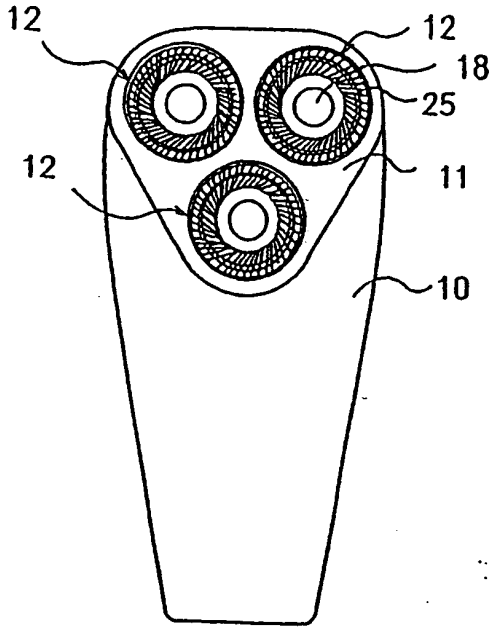

FIG. 4

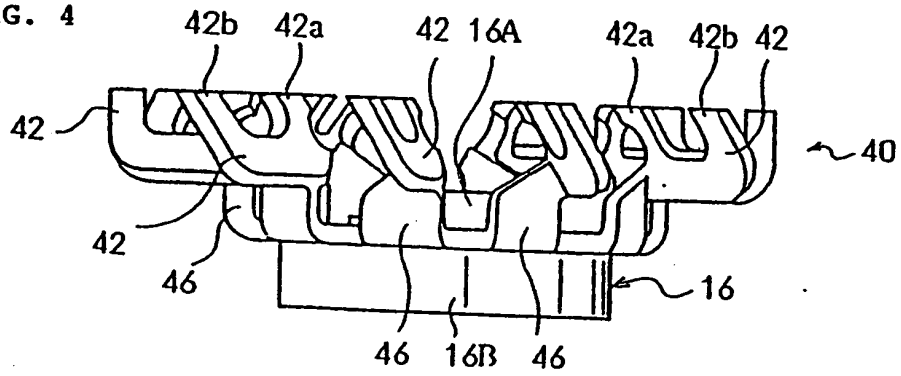

FIG. 5

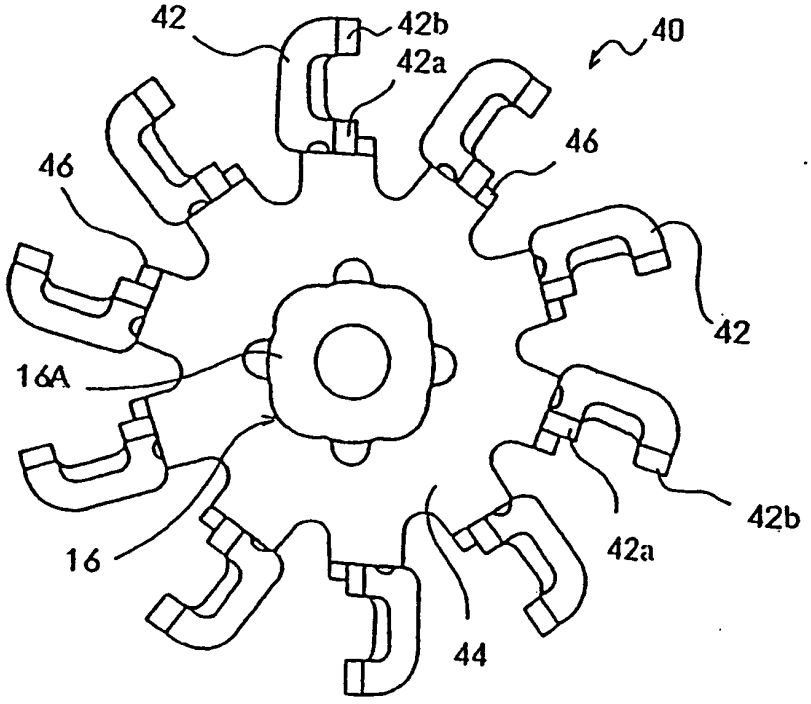

FIG. 6

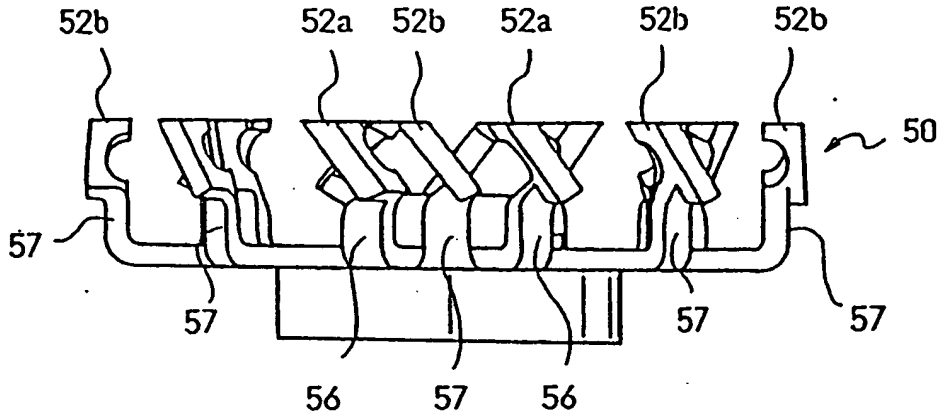
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FIG. 7

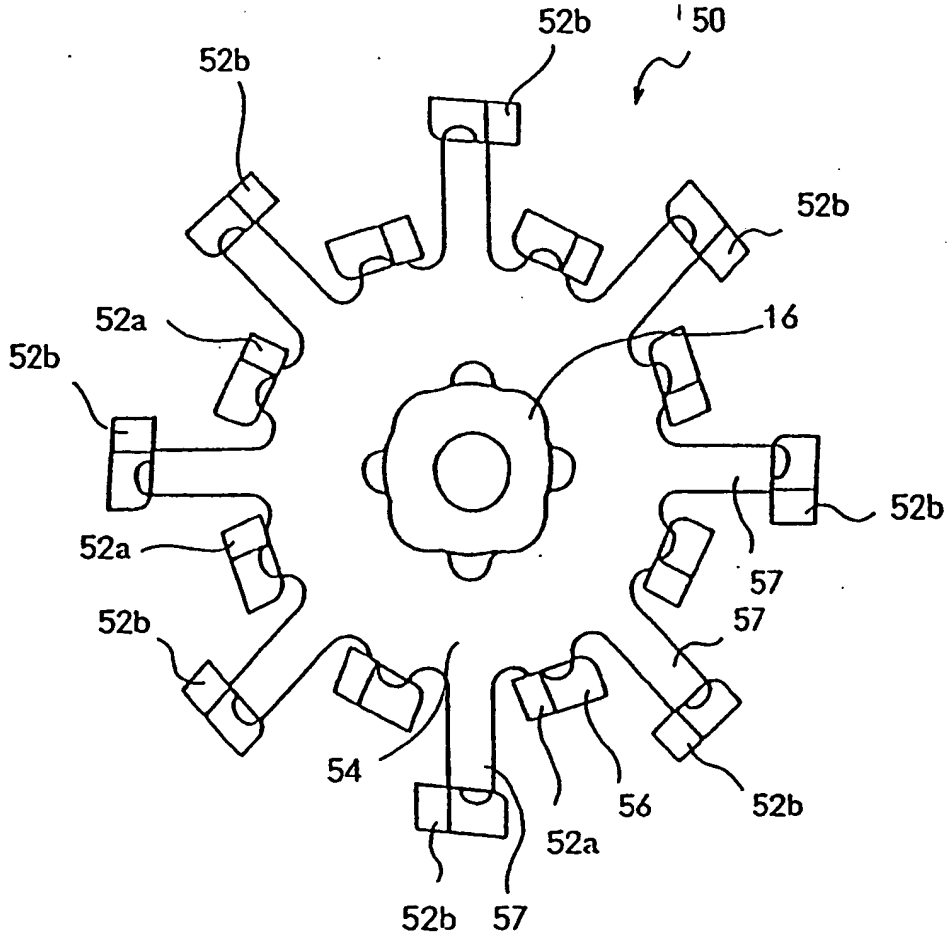
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FIG. 8

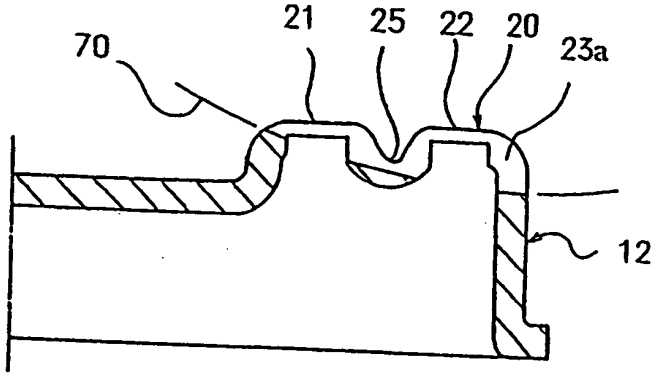
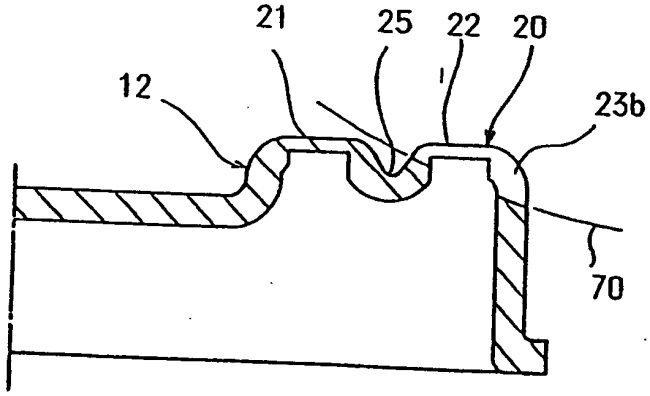


FIG. 9



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EUROPEAN SEARCH REPORT

Application Number
EP 93 30 1667

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X Y	FR-A-895 433 (N.V. PHILIPS GLOEILAMPENFABRIEKEN) * page 2, line 55 - page 3, line 46; figures *	1-6 7,8	B26B19/14
Y	EP-A-0 378 266 (N.V. PHILIPS GLOEILAMPENFABRIEKEN) * column 1, line 50 - column 3, line 48; figures 1-3 *	7,8	
X Y	US-A-3 116 551 (N.T. ANTON) * column 2, line 50 - column 4, line 55; figures 1-5,7 *	1,3,4,6 2,5	
Y	IT-B-571 355 (G. GATTI) * figures *	2,5	
X	US-A-3 119 180 (J. BRUECKER) * column 2, line 38 - column 4, line 30; figures *	1,4,6	
A D	FR-A-1 406 225 (N.V. PHILIPS GLOEILAMPENFABRIEKEN) * page 2, left column, paragraph 9 - right column, paragraph 7; figures * & JP-B-41 014 339 (...)	1,2	TECHNICAL FIELDS SEARCHED (Int. Cl.5) B26B
A	GB-A-2 057 333 (MATSUSHITA ELECTRIC WORKS LTD.) * page 1, line 100 - page 2, line 5; figures 1-3 *	4-6	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 JULY 1993	RAVEN P.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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